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Application of the low-finesse γ -ray frequency comb for high-resolution spectroscopy

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Abstract

© 2016 American Physical Society.High-finesse frequency combs (HFC) with large ratio of the frequency spacing to the width of the spectral components have demonstrated remarkable results in many applications such as precision spectroscopy and metrology. We found that low-finesse frequency combs having very small ratio of the frequency spacing to the width of the spectral components are more sensitive to the exact resonance with absorber than HFC. Our method is based on time domain measurements reviling oscillations of the radiation intensity after passing through an optically thick absorber. Fourier analysis of the oscillations allows to reconstruct the spectral content of the comb. If the central component of the incident comb is in exact resonance with the single line absorber, the contribution of the first sideband frequency to oscillations is exactly zero. We demonstrated this technique with γ-photon absorption by Mössbauer nuclei providing the spectral resolution beyond the natural broadening.

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